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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/814,682	03/31/2004	Wen Lin	LIN 13-38	8308

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HITT GAINES, PC
AGERE SYSTEMS INC.
PO BOX 832570
RICHARDSON, TX 75083

EXAMINER	
MALDONADO, JULIO J	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 12/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/814,682	LIN ET AL.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 October 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21,23-27 and 37-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *21, 23-27 and 37-40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/23/2006 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 21, 23-27 and 37-40 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. In amended claims 21, and 37, Applicants recite, "...a buried layer substantially of germanium located over a doped substrate...". However, while there is a support for a co-doped germanium layer comprising silicon doped with germanium (Instant paragraphs [0048] – [0055]), there is no support in the submitted disclosure nor in the original claims for a "buried layer substantially of germanium", making amended claims 21 and 37 lack written description.

Claim Objections

4. Claim 37 is objected to because of the following informalities: In claim 37, where applicants recite "...a buried layer located over a doped substrate, said buried layer doped throughout with germanium and a p-type dopant...interconnects located within interlevel dielectric layers located over said transistors, which *connect* said transistors to form an operation integrated circuit", change to -- a buried layer located over a doped substrate, said buried layer doped throughout with germanium and a p-type dopant...interconnects located within interlevel dielectric layers located over said transistors, *which provide connection to* said transistors to form an operation integrated circuit--. Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 21 and 23-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ouyang et al. (U.S. 6,319,799 B1, hereinafter Ouyang) in view of Bean et al. (U.S. 4,879,256, hereinafter Bean).

In reference to claims 21, 23, Ouyang (Figs.1-2C) teaches a transistor structure including a doped silicon substrate (10); a buried layer (30) made of silicon germanium having the general formula $Si_{1-x}Ge_x$ doped with germanium and boron (Fig.2B); a doped silicon epitaxial layer (34) over said buried layer (30); and a transistor structure (16, 18,

20, 22, 24) formed over said silicon epitaxial layer (34) (Ouyang, column 2, line 22 – column 3, line 65).

Ouyang fails to disclose wherein the buried layer is substantially germanium. However, Ouyang is open to form $Si_{1-x}Ge_x$ at any ratio. Furthermore, Bean (Figs.1 and 4) teaches a transistor structure including a substrate (1); a buried layer made of silicon germanium and having the formula $Si_{1-x}Ge_x$, wherein x is between 0 and 1; an upper layer (7) made of silicon; and a transistor structure (G) formed over said upper layer (7) (Bean, column 2, line 52 – column 3, line 21). Therefore, Bean is open to a buried layer substantially of germanium.

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Ouyang and Bean to enable the buried layer of Ouyang according to the teachings of Bean because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable materials for the buried layer of Ouyang and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

In reference to claims 24, 25, the combination of Ouyang and Bean substantially teach all aspects of the invention but fails to disclose wherein the boron concentration of the co-doped germanium buried layer ranges from about $1x10^{15}$ atoms/cm^3 to about $1x10^{20}$ atoms/cm^3, a dopant concentration of the doped substrate ranges from about $1x10^{14}$ atoms/cm^3 to about $1x10^{15}$ atoms/cm^3, and a dopant concentration of the doped epitaxial layer ranges from about $1x10^{14}$ atoms/cm^3 to about $1x10^{15}$ atoms/cm^3. However, the selection of the selected dope ranges is obvious because it is a matter of

determining optimum process condition by routine experimentation with a limited number of species to obtain a desired dopant concentration on the substrate, germanium layer and the epitaxial layer. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the combination of Ouyang and Bean to arrive at the claimed invention.

In reference to claims 26 and 27, the combined teachings of Ouyang and Bean substantially teach all aspects of the invention but fail to disclose wherein the co-doped germanium buried layer has a thickness ranging from about 1 μm to about 10 μm, and wherein the doped substrate, co-doped germanium buried layer, and the doped epitaxial layer collectively have a thickness ranging from about 2 μm to about 20 μm. Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

7. Claims 37-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ouyang ('799) in view of Bean ('256) and Ramadani et al. (U.S. 7,067,856 B2, hereinafter Ramadani).

In reference to claims 37, 38 and 40, Ouyang (Figs.1-2C) teaches a transistor structure including a doped silicon substrate (10); a buried layer (30) made of silicon germanium having the general formula $Si_{1-x}Ge_x$ doped with germanium and boron (Fig.2B); a doped silicon epitaxial layer (34) over said buried layer (30); and a transistor structure (16, 18, 20, 22, 24) formed over said silicon epitaxial layer (34) (Ouyang, column 2, line 22 – column 3, line 65).

Ouyang fails to disclose wherein the buried layer is substantially germanium. However, Ouyang is open to form $Si_{1-x}Ge_x$ at any ratio. Furthermore, Bean (Figs.1 and 4) teaches a transistor structure including a substrate (1); a buried layer made of silicon germanium and having the formula $Si_{1-x}Ge_x$, wherein x is between 0 and 1; an upper layer (7) made of silicon; and a transistor structure (G) formed over said upper layer (7) (Bean, column 2, line 52 – column 3, line 21). Therefore, Bean is open to a buried layer substantially of germanium.

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Ouyang and Bean to enable the buried layer of Ouyang according to the teachings of Bean because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable materials for the buried layer of Ouyang and art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

The combined teachings of Ouyang and Bean fail to expressly disclose wherein said transistor structure further includes interconnects located within interlevel dielectric layers located over transistors, which connect the transistors to form an operational integrated circuit and additional active and passive devices.

However, it is well-known in the art directed to MOS devices that these devices further include interconnects and other active and passive devices located within interlevel dielectric layers located over the transistors, which connect the transistors to form an operational integrated circuit. Further support can be in Ramdani (Figs.7-11 and column 13, line 38 – column 16, line 21). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the device of the combination of Ouyang and Bean would also include the claimed limitations as is well-known or as supported by the teachings of Ramdani.

In reference to claim 39, the combination of Ouyang Bean and Ramdani substantially teach all aspects of the invention but fails to disclose wherein the boron concentration of the co-doped germanium buried layer ranges from about $1x10^{15}$ atoms/cm^3 to about $1x10^{20}$ atoms/cm^3, a dopant concentration of the doped substrate ranges from about $1x10^{14}$ atoms/cm^3 to about $1x10^{15}$ atoms/cm^3, and a dopant concentration of the doped epitaxial layer ranges from about $1x10^{14}$ atoms/cm^3 to about $1x10^{15}$ atoms/cm^3. However, the selection of the selected dope ranges is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a desired dopant concentration on the substrate, germanium layer and the epitaxial layer. Therefore, it

would have been obvious to one of ordinary skill in the art at the time the invention was made to use the combination of Ouyang, Bean and Ramdani to arrive at the claimed invention.

Response to Arguments

8. Applicant's arguments with respect to claims 21, 23-27 and 37-40 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (http://portal.uspto.gov/external/portal/pair) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

11. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at http://www.uspto.gov/web/info/2800.htm.

MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

Julio J. Maldonado
Patent Examiner
Art Unit 2823

Julio J. Maldonado
November 29, 2006